GUIDELINES FOR THE SCIENTIFIC STUDY OF OIL SPILL EFFECTS

STUDY ELEMENT 12

INLAND SPILLS

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Revision No. 0
Revision Date: December 10, 1999

INTRODUCTION

While not as large as catastrophic marine oil spills, inland spills can be just as harmful to the impacted area. The latter are often exacerbated because of rapid transport by flowing water. An environmental assessment of the effects of inland spills can be as important as those in marine areas.

We had hoped to provide detailed guidance on selection of studies to evaluate inland oil spill effects but unfortunately there was insufficient time and budget to do so. Fortunately many of the techniques used for marine studies can be applied to inland situations, either as-is or with some modifications. In the Rationales below, references to some of the Methods in these *Study Guidelines* that may be useful in Inland studies are provided. These represent only some of the possible approaches to such studies, but they at least provide a starting point in the selection process. It is left to the reader to decide which, if any, of these will be appropriate in a particular spill situation, and whether or not modification of the procedures will be necessary.

TYPES OF STUDIES

A. SITE DESCRIPTION

Many of the methods found in Study Element 1–*Overflights, Photodocumentation, & Shore Description* can be applied to inland situations. Some modifications may be required.

A.1 Aerial Reconnaissance and Videotape Survey

The following methods will be useful, but modifications may be needed in smaller rivers and streams:

Method 1.1–*Aerial Reconnaissance Survey Procedures*
Method 1.2–*Aerial Videotape Survey Procedures.*

A.2 Ground Assessment Survey

Descriptions of procedures to describe impacted stream and lake shorelines can be taken from the following Methods:

Method 1.3–*Ground Assessment Survey Procedures* (follow up to aerial surveys, evaluate response options)
Method 1.4–*Ground Assessment Survey Documentation* (provides standardized terminology)
Method 1.5–*Data Reduction and Management* (for input to GIS or database system)
Method 1.6–*Shoreline Segmentation* (provides a common system of shoreline identification for response and impact evaluation)
Method 3.1–*Site Selection and Setup* (to identify parts of shorelines for further study)

Method 3.2–*Beach Morphology and Oil Monitoring* (to establish baseline and document changes)
Method 5.1–*Site Selection, Setup, and Photodocumentation* (to establish shoreline biota sampling stations)
Method 6.1–*Site/Station Selection and Documentation* (to establish underwater benthic sampling stations).

B. ABIOTIC SAMPLING

The Methods described in Study Element 2–*Water Column & Oil Source Sampling* and Study Element 3–*Shoreline and Sediment Sampling* should also work for inland spills.

B.1 Oil and Water

Method 2.1–*Discrete Water Sample Collection and Handling* (using water bottles)
Method 2.2–*Continuous Water Sample Data Collection/Sample Handling* (using pumps)
Method 2.4–*Source Oil Sample Collection and Handling* (sampling the source of the spilled oil is very important)
Method 3.2–*Beach Morphology and Oil Monitoring* (to document changes in shoreline oiling conditions through time).

ASTM (1997) provides the following Standard Methods:
D 5358-93, Practice for sampling with a dipper or pond sampler
D 4489-95, Practices for sampling waterborne oils
D 3325-90, Practice for preservation of waterborne oil samples.

B.2 Sediment

Methods found in these *Study Guidelines* include the following.

Method 3.2–*Beach Morphology and Oil Monitoring* (to document changes in shoreline oiling and provide physical data for correlation with biological data if appropriate)
Method 3.3–*Shoreline Sediment Sampling – Surface Sediment*
Method 3.4–*Shoreline Sediment Sampling – Subsurface Sediment*
Method 3.5–*Sediment Grain Size (Coarse) Analysis – Field*
Method 3.6–*Offshore Sediment Sampling from Vessels* (may not be appropriate in swiftly flowing streams)
Method 3.7–*Offshore Sediment Sampling using SCUBA* (an alternative method in lakes)
Method 3.8–*Vessel Positioning* (of value in very large lakes)
Method 3.9–*Sediment Traps* (for collecting settling particulate matter in ponds and lakes)
Method 3.10–*Suspended Sediment Sampling* (to sample suspended particulate matter using bottle samplers).

ASTM (1997) provides the following Standard Methods:
D 4700-91, Guide for soil sampling from the vadose (unsaturated) zone
D 1452-80, Practice for sampling by auger borings
D 4823-95, Guide for core-sampling submerged sediments
D 3976-92, Practice for preparation of sediment samples for chemical analysis
D 1391-94, Guide for handling sediments for toxicological testing (see also Method 8.1–*Collection, Transport, and Storage of Samples for Toxicity Testing*).

C. VEGETATION

Several of the Methods designed for sampling *intertidal biota* (Study Element 5) can be applied to sampling freshwater vegetation.

Method 5.1–*Site Selection, Setup, and Photodocumentation* (for selecting and documenting sampling sites).

C.1Submerged Aquatic Plants

Method 5.3–*Algal Growth Studies* (can be modified for freshwater vegetation)
Method 6.4–*Seagrass Sampling* (for sampling beds for other aquatic vegetation).

C.2Emergent Aquatic & Wetland Plants

Method 5.2–*Emergent Vegetation Sampling* (for quantifying marsh vegetation)
Method 5.3–*Algal Growth Studies* (can be modified for freshwater vegetation).

C.3Terrestrial, Riparian Plants

Method 5.5–*Visual Estimation of Abundance and Percent Cover in Quadrats* (can be used for vegetation)
Method 5.6–*Point Contact Estimation of Percent Cover in Quadrats* (can be used for vegetation).

D. INVERTEBRATES

Many of the methods found in Study Element 5–*Intertidal Biota* and Study Element 6–*Subtidal Biota* will also work (with and without modification) in inland, freshwater environments also.

D.1Aquatic

The utility of different (originally written for marine habitats) methods will vary according to the freshwater habitat being sampled: lake and pond or river and stream; hard or soft substrate.

Method 5.5–*Visual Estimation of Abundance and Percent Cover in Quadrats*
Method 5.6–*Point Contact Estimation of Percent Cover in Quadrats*
Method 5.7–*Epibenthic Zooplankton Sampling*
Method 5.8–*Macro-Infaunal Sampling* (those larger than 0.5 or 1 mm in the top 15 cm of sediment)
Method 5.9–*Age and Growth of Hardshelled Clams*
Method 5.10–*Mega-Infaunal Sampling* (larger organisms in the upper 20 cm of sediment)
Method 5.11–*Meiofauna Sampling* (between 0.063 mm and 0.5 or 1 mm in size)
Method 5.12–*General Procedures for Biological Sample Processing* (primarily re invertebrates but generally applicable to other flora and fauna as well)
Method 6.2–*Subtidal Quadrat Sampling* (conducted with SCUBA)
Method 6.3–*Subtidal Transect Sampling* (conducted with SCUBA)
Method 6.5–*Macro-Infaunal Sampling* (using SCUBA or grab samplers)
Method 6.6–*Epibenthic Zooplankton Sampling* (using suction sampler or epibenthic sled).

ASTM (1997) provides the following Standard Methods:
D 4556-85, Guide for selecting stream-net samplers for benthic macroinvertebrates (includes a useful table for comparing sampler performance)

D 4557-85, Practice for collecting benthic macroinvertebrates with Surber (et al.) samplers
D 4558-85, Practice for collecting benthic macroinvertebrates with drift nets
D 4387-84, Guide for selecting grab samplers for benthic macroinvertebrates (includes a useful table for comparing sampler performance)
D 4342-84, Practice for collecting benthic macroinvertebrates with Ponar grab sampler
D 4343-84, Practice for collecting benthic macroinvertebrates with Ekman grab sampler
D 4344-84, Practice for collecting benthic macroinvertebrates with Smith-McIntyre grab sampler
D 4345-84, Practice for collecting benthic macroinvertebrates with Van Veen grab sampler
D 4346-84, Practice for collecting benthic macroinvertebrates with Okean 50 grab sampler
D 4347-84, Practice for collecting benthic macroinvertebrates with Shipek (scoop) grab sampler
D 4348-84, Practice for collecting benthic macroinvertebrates with Holme (scoop) grab sampler
D 4401-84, Practice for collecting benthic macroinvertebrates with Peterson grab sampler
D 4407-84, Practice for collecting benthic macroinvertebrates with Orange Peel grab sampler
E 1468-92, Practice for collecting benthic macroinvertebrates with basket sampler
E 1469-92, Practice for collecting benthic macroinvertebrates with multiple-plate sampler.

D.2 Terrestrial

Method 5.5–*Visual Estimation of Abundance and Percent Cover in Quadrats*
Method 5.6–*Point Contact Estimation of Percent Cover in Quadrats.*

E. FISH

Many of the methods found in Study Element 10–*Nekton* will also work (with and without modification) in inland, freshwater environments also. Most can be used in still waters (lakes and ponds) and some will work in flowing waters (rivers and streams).

Method 10.1–*Active Net Fishing*
Method 10.2–*Passive Samplers*
Method 10.4–*Direct Collection Methods*
Method 10.5–*In Situ Bioassay Methods for Pelagic Fish*
Method 10.6–*Standard Field and Laboratory Methods for Processing of Nekton Samples*
Method 10.7–*Fish Aging.*

F. TERRESTRIAL VERTEBRATES

There are no detailed methods in these *Study Guidelines* (which are written for marine sampling) that apply to sampling terrestrial vertebrates (mammals, reptiles, and amphibians).

G. BIRDS

Many of the methods found in Study Element 9–*Birds and Maine Mammals* will also work (with and without modification) in inland, freshwater environments also. Most can be used in still waters (lakes and ponds) and some will work in flowing waters (rivers and streams).

G.1 Aerial Surveys

Many of these methods will work in large lakes; fewer can be used in small flowing systems.

Method 9.1–*Aerial Survey Logistics and Planning*
Method 9.2–*Aerial Navigation*
Method 9.3–*Open Water Bird and Marine Mammal Surveys*
Method 9.4–*Exposed Shoreline Bird and Marine Mammal Surveys*

Method 9.5–*Bay, Tidal Wetland, and Estuarine Surveys*
Method 9.6–*Permits*.

G.2 Ground Surveys

These *Study Guidelines* do not contain live-bird survey methods (such as stream-side observation or listening surveys). The following methods apply to searching for and retrieving oiled birds (and other animals) along shorelines.

Method 9.7–*Beached Animal Survey Coordination*
Method 9.8–*Allocation of Search Effort for Beached Birds and Mammals*
Method 9.9–*Beached Animal Retrieval*
Method 9.10–*Beached Carcass Analysis*.

H. SUPPORTING METHODS

There are additional procedures found in these Study Guidelines that can be applied to inland, freshwater situations. Methods for analytical *Chemistry* are found in Study Element 4. The *Toxic Effects* of oil in water or sediment can be determined in methods described in Study Element 8. Study Element 13 describes programmatic *Quality Control/Quality Assurance* methods. A *Data Management* system is described in Study Element 14.

REFERENCES

ASTM. 1997. ASTM Standards on Environmental Sampling, Second Edition. American Society for Testing and Materials. West Conshohocken, PA. 1008 p.